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Testing and Evaluation of Animal Drawn Multi Purpose Tool Seed cum Fertilizer Drill

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Abstract : ***The investigation was undertaken in Research Farm of Faculty of Agricultural Engineering, IGKV Raipur (Chhattisgarh) during period of kharif season. The MPT seed drill was tested for direct sowing of paddy and its performance evaluation was carried out with animal drawn conventional seed cum fertilizer drill. During the laboratory testing, the seed rate was measured at different hopper capacities and for various exposure length of fluted roller. The recommended seed rate i.e. 76.80 kg/ha was found at 10 mm fluted roller exposure length and at full hopper capacity. The draft and power requirement were measured for MPT seed cum fertilizer drill in field and found to be 53.7 kgf and 0.4 hp respectively. The actual field capacity and field efficiency was found to be 0.0853 ha/h and 73.9 % respectively. The energy output was found to be 134871 MJ/ha and 148319 MJ/ha for MPT seed cum fertilizer drill and conventional seed cum fertilizer drill respectively. The output-input ratio was found 17.47 for MPT seed cum fertilizer drill and 18.43 for conventional seed cum fertilizer drill. Yield and energy input output ratio was found little more in conventional seed drill as compare to MPT seed drill but in case of MPT seed drill there was feasibility of attaching different implements for number of field operation.***

Keywords: Calibration, Seed cum Fertilizer drill, Seed rate, Energy input output ratio.

I. Introduction

Agricultural development is usually regards as a requirement of development. It is fact that economic growth in current times has to be associated with industrialization, nevertheless, it is generally accepted that industrialization be capable of follow only on the sound heels of agriculture. Agriculture is the foundation on which the entire superstructure of the growth of industrial sector and other sectors of the economy has to stand. Indian economy still displays explicit character typical of the most underdeveloped countries of the world [x]. Crop cultivation requires application of both animate (bullock, human power) and inanimate (tractors, tillers etc.) forms of energy at different stages. Nutrients are provided through Farm Yard Manure (FYM), chemical fertilizer or both. Pesticides are required to check or prevent pest attack [vii]. Irrigation is done either manually (manually and animal operated) or through diesel/electric pump sets (to lift ground Water). Besides this, energy is required for processing the output and transporting it to consumer centres.

Preparation of seed bed is a specialized task which requires skill, time energy and labour in addition to different soil manipulating implements. The first seed cum fertilizer drills was small enough to be drawn by a single animal but the availability of source and, later, gasoline tractors shows the development of larger and more efficient drills that allowed farmers to seed even larger tracts in a single day [xiii]. Recent improvements to drills permit seed-drilling without prior tilling. Main objectives taken in the research are to conduct a testing of animal drawn MPT seed cum fertilizer drill for direct seeded paddy and study comparative performance evaluation of MPT seed cum fertilizer drill and conventional Seed cum fertilizer drill.

Fig.1: Bullock Drawn MPT Seed cum Fertilizer Drill

In 1983, Sharma *et al.* [xvi] designed and developed a single row seed cum fertilizer drill with frame of 40×40×3 mm mild steel angle iron. A 30 cm diameter lugged wheel has made from 30×5 mm mild steel flat with 25 mm long lugs welded on it. The rectangular boxes one for seed and other for fertilizer 5 kg capacity were fabricated from 20 gauge mild steel sheet separated fluted roller assembly were provided to ensure uniform dropping. In 1984, Tondon *et al*. [xvii] reported that the speed ratio of ground drive wheel to seed metering shaft was 2-2.5:1 and that to fertilizer shaft was 3:1. In 1988, Senapati *et al*. [xv] tested six seed drills for upland rice and found that 2 row seed cum fertilizer drill had the highest performance index (3.3) seed distribution efficiency 81% and desire number of plant per row is 28. In 1989, Mishra *et al*. [xii] studied the energy requirement for growing wheat after harvesting of paddy with different machinery management systems being used in Nainital district. Energy inflow ranged 15.3 to 17.4 GJ/ha and outflow 77.0 to 106.5 GJ/ha. Energy outflow inflow ratio varied from 4.6 to 6.4 per various machinery management systems. It was found that maximum energy outputs (106 GJ/ha) was obtained in rotavator (2 times) and roller (1 pass) systems as compared to other combinations such as plough, harrow, cultivator and

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plankar two passes. In 1991, Devnani [vi] suggested the box capacity for animal drawn seed drill should be 10-16 liter. He set that fluted roller mechanism was suitable for all type of seed which would manage seed rate accurately. In study it is reported that the inclination of the seed delivery tube from vertical was kept smaller than 20 degree. Study shows that draft for each of shoe type furrow opener was 20 kgf for light soil and 30-35 kgf for heavy soil. In 1991 Vershney *et al*. [xviii] designed and developed power tiller operated seed cum fertilizer drill with chain and sprocket power transmission system. They reported that fluted roller for metering of seed and adjustable opening for fertilizer gave better results for placement of seed and fertilizer.

In 1992, Adil *et al*. [i] carried out study concerned with the energy output relationship for wheat and cotton and energy consumption pattern by farm size in Pakistan. The study reflected a positive relationship between the energy level and the output of wheat or cotton per acre. Pakistan consumed energy at a level almost 50 per cent of the average energy consumption in developing countries. The input of energy is a factor to influence productivity In 1995, Behera *et al.* [ii] settled that Naveen seed cum fertilizer drill of CIAE Bhopal gives the best performance in term of highest return of Rs.4693.75/ha and benefit ratio of 1.35. In 1995, Qasim and Verma [xiv] deliberate on performance of line sowing implement on loam clay soil and started that Indira seed drill, Nari, Datari are suitable for line sowing of paddy in C.G. Indira seed drill cover 0.8-1.0 ha/day with draft required was 25-30 kg.

In 2011, Kumar and Hugar [xi] examined the energy use pattern in paddy cultivation under irrigated situations. The study resulted with observation that the total energy utilized for paddy cultivation by small farmers (6,237MJ/acre) was significantly higher than that of medium (5,501MJ/acre) and large (5,303MJ/acre) farmers. In 2013, Yadav *et al*. [xix] presented energy input–output and the level of agricultural mechanization for cultivation of rice and maize. In this study it is found that the traditional practices of cultivation of rice and maize crops consumed an average energy input of 3,338.984 MJ/ha and 4,386.435 MJ/ha. The output–to–input energy ratio was observed to be 7.66 and 5.86 for rice and maize, respectively.

II. Material and Methods

Field experiment were conducted during kharif at faculty of Agricultural Engineering Farm Indira Gandhi Krishi Vishwavidyalaya Raipur (Chhattisgarh) situated at longitude 21.16° and latitude 81.36° at an elevation of 289.56 m above from mean sea level to evaluate. The field performance test was conducted in order to obtain actual data for over all machine performance operating, accuracy, work capacity,
The theoretical field obtain if implement were performing its function 100% of the time at the rated speed and always covering 100% of its rated width. Field capacity was calculated by following expression:

$$TFC = (W \times S) / 10 \quad (1)$$

Where, TFC = theoretical field capacity, W = theoretical width of implement, m and S = speed of operation.

Actual field capacity was determine by expression given as

$$AFC = A / T \quad (2)$$

Table 1: Specification of MPT Seed cum Fertilizer Drill

S.No.	Parameter	Specification
1	Length	1070 mm
2	Width	640 mm
3	Height	940 mm
4	Row spacing	200 mm
5	Furrow opener type	Inverted ‘T’
6	Metering Mechanism	Fluted roller
7	Power transmission	Chain and sprocket

Where AFC = Actual field capacity, A = actual area covered by implement, ha and T = effective time, h. Field Efficiency is determine by the ratio of actual field capacity and theoretical field capacity. Energy input is considered source wise and operation wise input with different parameter. Energy input was calculated by expression given as

$$\text{Energy input} = E_{hl} + E_{p} + E_{mt} \quad (3)$$

Where, E_{hl} = energy from human labour, E_p = energy from power and E_{mt}= energy from materials

Energy output is given by expression given as

$$\text{Energy output} = E_{mp} + E_{bp} \quad (4)$$

Where E_{mp} = energy from main product and E_{bp} = energy from by-product.

III. Result and Discussion

The seed cum fertilizer drill machine was calibrated for the desired seed rate by adjustment of the exposed length of flutes. Wide range of quantity of seeds dropped through the flute was collected during the calibration of seed cum fertilizer drill.

The seed rate was increased with in decrease in hopper capacity and increased in fluted roller exposure length.

Table 2: Calibration of MPT Seed cum Fertilizer Drill

crop	Exposed length, mm	Seed rate, kg/ha			
		full	3/4	1/2	1/4
Paddy	7	44.50	49.20	52.65	53.60
	10	76.80	78.54	82.90	84.50
	13	116.50	120.40	126.90	128.30

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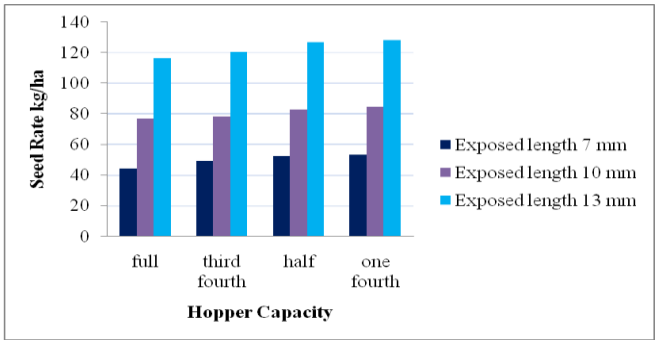

Fig. 2: Seed rate at different hopper capacity

The recommended seed rate was found 76.80 kg/ha at 10 mm exposed length of fluted roller. The Actual field capacity was calculated from field. It was observed that the effective field capacity of MPT seed cum fertilizer drill was 0.083 ha/hr and 0.093 ha/hr for conventional seed cum fertilizer drill.

Table 3: Field capacity and efficiency of MPT Seed cum Fertilizer drill

Implement	TFC, ha/h	AFC, ha/h	Efficiency, %
MPT Seed cum Fertilizer drill	0.115	0.085	73.9
Conventional Seed cum Fertilizer drill	0.132	0.093	70.4

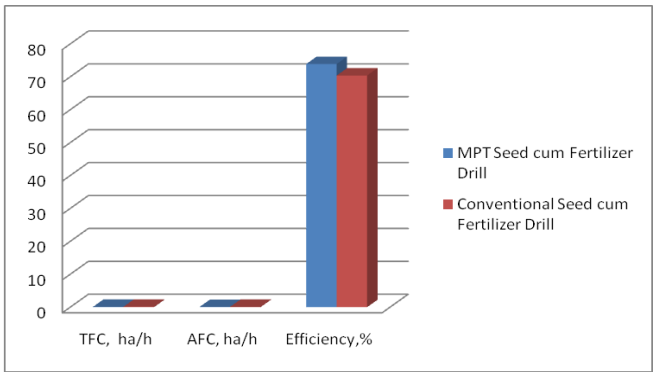

Fig. 3: Comparision of MPT and Conventional Seed cum Fertilizer Drill

Table 4: Operation wise energy input in paddy cultivation by Conventional Seed cum Fertilizer drill and MPT Seed cum Fertilizer Drill

Operation	Conventional Seed cum Fertilizer Drill MJ/ha	MPT Seed cum Fertilizer drill MJ/ha
Field preparation	276.03	278.82
Sowing	1338.22	1388.47
Plant protection	56.92	46.6
Intercultural	131.71	155.8
Irrigation	45.68	57.1
Fertilizer application	4319.05	4022.68
Harvesting	308.93	312.56
Threshing	767.88	125.72
Winnowing	282.41	722.12

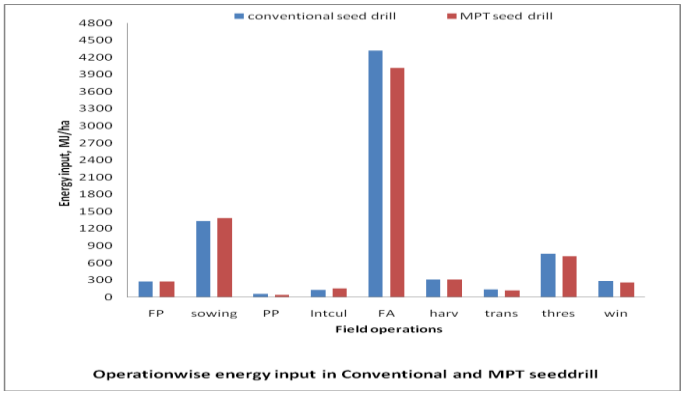

Fig. 4: Operationwise energy input for MPT Seed cum Fertlizer drill and Conventional Seed cum Fertilizer drill

Table 5: Energy output - input ratio for MPT and conventional Seed cum Fertilizer drill

Implement	Energy input MJ/ha	Energy output MJ/ha		Total output MJ/ha	Out Put-input ratio
		Seed	Straw		
MPT Seed cum Fertilizer drill	7726.5	65121	69750	134871	17.4
Conventional Seed cum Fertilizer drill	8018.3	66444	81875	148319	18.4

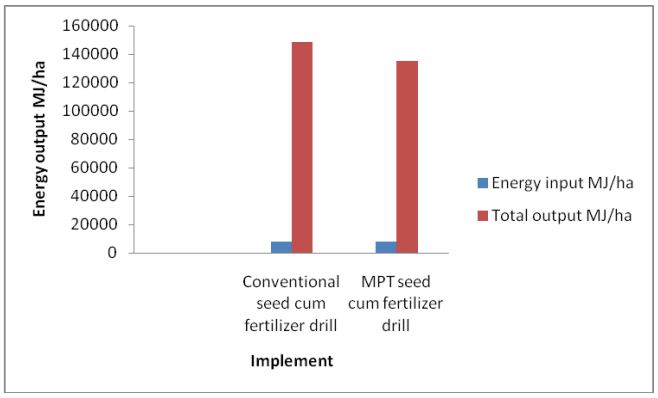

Fig.5: Comparison in energy output in Conventional And MPT Seed cum fertilizer drill.

IV. Conclusions

The Testing and performance evaluation of Animal Drawn Multi Purpose Seed cum Fertilizer Drill was carried out in an area of 0.05 ha at Faculty of Agricultural Engineering, IGKV, Raipur, Chhattisgarh. During the laboratory testing, the seed rate was calculated at different hopper capacities and for various exposure length of fluted roller. The recommended seed rate 76.80 kg/ha was found at 10 mm fluted roller exposure length and at full hopper capacity. The actual field capacity and field efficiency was found to be 0.0853 ha/h and 73.9 % respectively. This research shows that there was very little variation in performance with both the seed drills but

MPT was suitable different implement attachment for number of field operations like tillage, sowing, inter-cultural operation etc. Efficiency of the MPT Seed cum fertilizer drill was more effective as compare to Conventional Seed cum fertilizer drill and energy input is lesser than energy input required in conventional seed cum fertilizer drill.

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